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ABSTRACT

This study investigated the hypotheses that 1) infants delivered from a left occiput anterior or transverse position (LOA/LOT) would exhibit a right supine head orientation in the neonatal examination and a right hand preference at 19 weeks of age; and 2) infants delivered from a right occiput anterior or transverse position (ROA/ROT) would exhibit a neonatal head-left orientation and a left hand preference at 19 weeks of age. Head position at birth was assessed by the attending physician's recording of the position of the occiput of the fetus during four stages of labor and delivery. In the left occiput anterior and transverse group there were 23 males and 29 females; in the right occiput anterior and transverse group, there were 31 males and 21 females. Neonatal postural preferences were assessed, when the infant was between 12 and 96 hours of age, by observation of position of head, arms, and hands. Results showed that infants delivered LOA/LOT demonstrated a right neonatal head position preference, whereas infants delivered ROA/ROT did not demonstrate the expected left bias. The infants' head positions were evenly divided between right and left. At approximately 19 weeks of age, 76 of the 104 infants were examined on hand preference items selected from infant scales (Bayley, 1969; Lederer 1939), and one original stimulus. Sixty-four percent of these infants preferred the right hand and 32 percent preferred the left hand. In addition, significant relationships were found between the position of the head at birth and handedness at 19 weeks of age, and between neonatal head position preference and hand preference at 19 weeks of age. (Author/MP)

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BIRTH POSITION, NEONATAL HEAD POSITION PREFERENCE, AND HAND PREFERENCE IN 19-WEEK-OLD INFANTS

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This study is part of an ongoing longitudinal investigation of lateral preferences of infants and young children (Michel & Goodwin, 1979). Lateral preferences include position of the head during labor and delivery, neonatal head position preference, and hand preference at 19 weeks of age.

Prior to the time when infants are capable of reaching for objects and thus indicating a hand preference, they demonstrate lateral preferences in arm motility (Stubbs & Irwin, 1933), hand postures (Cobb, Goodwin & Saelens, 1966), and grasping (Caplan & Kinsbourne, 1976) in favor of the right. In addition, neonates typically lie with their heads to the right (Turkewitz, Gordon & Birch, 1965; Saling, 1979). There is some evidence that the side to which the infant prefers to turn his/her head is related to greater activation of the ipsilateral hand at 12 weeks of age (Coryell & Michel, 1978) and to hand preference in later infancy and childhood (Gesell & Ames, 1947; Gesell & Halverson, 1942).

Little is known about antecedent conditions which may affect lateral preferences, but relationships between fetal position and hand preferences have been suggested (Moss, 1929; Watson, 1924; Kopell, 1971). Churchill, Igna & Senf (1962) found a relationship between birth position and handedness at two years of age. Infants delivered from a left occiput anterior position picked up a ball with their right hand at age two, while infants who were delivered right occiput anterior picked up a ball with their left hand.

This study investigated the hypotheses that infants delivered from a left occiput anterior or transverse position would exhibit a right supine head orientation in the neonatal examination and a right hand preference at 19 weeks of age; and that infants delivered

from a right occiput anterior or transverse position would exhibit a neonatal head-left orientation and a left hand preference at 19 weeks of age.

Method

Subjects were 104 infants (50 females, 54 males) born between April and October, 1977 at the Beth Israel Hospital, Boston, Massachusetts and were products of normal pregnancies and deliveries.

Procedure

Head position at birth was assessed by the attending physician's recording of the position of the occiput of the fetus during four stages of labor and delivery; at inlet of pelvis, midpelvis, outlet, and restitution (head restitutes to the position in which it entered the pelvis) and as anterior, posterior, or transverse, and right or left relative to the mother. Only infants who were recorded as left occiput anterior or transverse (head turned to their right) or as right occiput anterior or transverse (head turned to their left) during at least two of the four stages were included in the study.

In the left occiput anterior and transverse group, there were 23 males and 29 females; in the right occiput anterior and transverse group, there were 31 males and 21 females.

Neonatal postural preferences were assessed when the infant was between 12 and 96 hours of age by observation of positions of head, arms, and hands. These postures were recorded every 10 seconds during the one minute subsequent to conditions in which the infant's head was held for one minute to the midline, to the right (right ear to the mattress), to the left (left ear to the mattress) and to midline for a second time. Each of the four conditions was for one minute.

Head position was coded midline when the nose/chin position was between the right and left nipple; right when the nose/chin position was to the right of the right nipple line, and left when the nose/chin position was to the left of the left nipple line. Intercoder reliability between two coders was 100 per cent.

State was coded asleep, drowsy, awake, fussing, and crying as adapted from Prechtl (1974). Intercoder reliability between two coders was 95 per cent. Hand positions were coded in four categories: tightly fisted, loosely fisted, partly open, and open (Cobb, Goodwin, & Saelens, 1966). Intercoder reliability between two coders was 90 per cent.

19-week handedness assessment: At about 19 weeks of age, 76 of the 104 infants were examined on hand preference items selected from infant scales (Bayley, 1969; Lederer, 1939) as well as one original stimulus. Objects were presented about 18 cm from the infant for 30 seconds, first to midline, then to the right, the left, and then two identical stimuli were placed to the right and left sides simultaneously. Items placed to either side were about 60 degrees from midline-- in front of either ear. The infant was either seated in a General Motors "LUV" seat, a car seat, or placed supine on a white quilt pad.

The examination was filmed and later analyzed at two and one half second intervals for hand activity. The hand which first responded to the stimulus was coded as either "approach", "contact", or "grasp". Intercoder reliability was 95 per cent.

Neonatal head position preference and 19-week hand preference scores were computed by the formula $Z = R-L/\sqrt{R+L}$. A positive score of +1.96 or greater indicated a significant right preference; a positive score of less than +1.96, a right bias; a negative score of less than -1.96 a left bias; and a negative score greater than -1.96, a significant left preference.

Results

Of the 104 infants, 47 (45 per cent) exhibited head position preferences to the right a significant amount of the time; 15 (14 per cent) were biased to the right; 20 (19 per cent) were biased to the left; and 17 (16 per cent) were to the left a significant amount of the time. Five (five per cent) infants exhibited no head position preference. Fifty-nine per cent preferred to turn right, and 35 per cent preferred the left. There is a significant association between birth position (LOA/LOT and ROA/ROT) and neonatal head position preference $x^2(3)=8.24, p < .05$ (Table 1). This relationship is significant for infants delivered LOA/LOT $x^2(3)=31.4, p < .001$, but not for infants delivered ROA/ROT, $x^2(3)=4.88, p < .20$. Thus, infants delivered LOA/LOT demonstrate a right neonatal head position preference; whereas, infants delivered ROA/ROT do not demonstrate the expected left bias; their head positions are evenly divided between right and left.

Of the 76 infants who were followed at 19 weeks, 20 (26 per cent) used their right hand in the reaching tasks a significant amount of the time; 29 (38 per cent) were biased to the right; 14 (18 per cent) were biased to the left; and 11 (14 per cent) reached with their left hand a significant amount of the time. Two infants (three per cent)

showed no preference. Sixty-four per cent of the infants preferred the right hand; 32 per cent preferred the left.

The position of the head at birth was significantly related to handedness at 19 weeks $x^2(3)=14.95, p<.001$ (Table 2). The relationship is significant for infants delivered LOA/LOT; these infants showed a right hand preference at 19 weeks of age. Although the chi square was significant at the .05 level, $x^2(3)=7.86, p<.05$, for the association between infants delivered ROA/ROT and their hand preference at 19 weeks, there was not the hypothesized preference for left handedness. Instead, these infants showed the amount of left handedness which could be attributed to chance, but less in the significant right category, and more in the right bias category than would be expected by chance. Infants delivered ROA/ROT are equally as likely to have a right as a left hand preference at 19 weeks (17 right, 18 left) when the two categories for right handedness are compared with the two categories for left handedness.

There is a significant relationship between neonatal head position preference and hand preference at 19 weeks of age $x^2(9)=17.1, p<.05$ (Table 3). Infants with a right neonatal head position preference (significant right and right bias combined) showed a right hand preference at 19 weeks $x^2(3)=2.01$. One of the problems with this analysis is that there are relatively few subjects with neonatal head position preferences which were "significantly left". There were 33 infants with head position preferences in the "significantly right" category, but only eight in the "significantly left" category. It looks like there

may be a shift to the left, but there are too few subjects in this group to make a meaningful statement. Interestingly, the handedness for infants whose head position preferences were in the right or left biased categories, showed hand preferences which were about evenly divided between the right and left.

Forty-eight of the 71 infants (68 per cent) demonstrated head preferences at 19 weeks of age which were in the same direction as their neonatal head position preferences; this similarity in preferred side for head-turning and handedness is significantly related to the position of the infant at birth, $x^2(1)=5.44, p < .02$ (Table 4). Of the 36 infants whose head and hand preferences were right, 22 (61 per cent) were delivered from the LOA/LOT position; of the 12 infants whose head and hand preferences were left, 10 of them (83 per cent) were delivered from the ROA/ROT position. Of the remaining 23 infants whose hand preference at 10 weeks was contralateral to their neonatal head position preference, 11 were delivered ROA/ROT and 12 LOA/LOT.

The only sex difference which appeared was more males than females exhibited "significantly left" hand preferences; $x^2(1)=4.5, p < .05$. There were no sex differences in neonatal head position preference.

There were no associations between a family history of left handedness and either neonatal head position preference or hand preference.

Discussion

Thus,infants delivered LOA/LOT demonstrated the predicted right shift in the distribution of their neonatal head position preferences and their hand preferences, but infants delivered ROA/ROT did not exhibit the predicted shift to the left in either their neonatal head position preferences or their hand preferences.

Little is known about causes of prenatal asymmetrical postures. One possible cause for the asymmetry could be the torsion of the uterus to the right in most pregnancies which causes the bladder to be displaced to the right. This displacement leaves more room on the left side for the left occiput position of the fetal head when it is anterior or transverse according to Taylor (1976). Another possibility is that the fetus has a preference for lying to one side and maintains that position a significant amount of the time during the gestation period. There is little information relative to the consistency of fetal positions during the last trimester of pregnancy and the relation to birth position. It is possible that infants delivered LOA/LOT remain more often in the LOA/LOT position prenatally than infants delivered ROA/ROT remain ROA/ROT prenatally. Although it has been found by radiographic technique (Dunn, 1976) that the position of the fetus prior to delivery corresponds to the neonatal "position of comfort" (Chapple & Davidson, 1941), finer analysis of intrauterine and extrauterine head position may reveal important lateral differences in postures between infants delivered LOA/LOT and those delivered ROA/ROT.

It has also been suggested that the supine asymmetrical head position preference leads to greater visualization of the hand on the side to which the head is turned and eventually to a hand-use preference (Gesell & Ames, 1947; Coryell & Michel, 1978). This investigation showed that head and hand preferences were significantly related for the right side, but not for the left. Because there were so few infants (eight) with neonatal head position preferences "significantly left", the relationship of that psoition to later handedness is unclear at present. It is position that neonatal head position preferences are related to later hand preferences through the constraints of the postures on the developing eye-hand coordination, but this study did not examine visual abilities of the neonates, nor did it examine lateral preferences in the period between the neonatal one and 19 weeks of age. Detailed examination of the asymmetries of prenatal and postnatal head position preferences and hand postures and use during the neonatal period and early infancy, in addition to the infant's visual capabilities, are necessary in order to understand the role of postures and vision on the developing lateral preferences, in particular, the left-sided preferences.

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TABLE 1

RELATION BETWEEN NEONATAL HEAD POSITION PREFERENCE AND BIRTH POSITION (N = 99)

BIRTH POSITION	NEONATAL HEAD POSITION PREFERENCE				
	SIG. RIGHT	RIGHT BIAS	LEFT BIAS	SIG. LEFT	X^2 (df=3)
LOA/LOT	29	8	8	4	31.4 ***
ROA/ROT	18	7	12	13	4.88 NS
OVERALL CHI SQUARE					8.24 *

* $p < .05$

*** $p < .001$

TABLE 2

RELATION BETWEEN BIRTH POSITION
AND INFANT HANDEDNESS AT 19 WEEKS

BIRTH POSITION (N = 74)	INFANT HANDEDNESS				
	SIG. RIGHT	RIGHT BIAS	LEFT BIAS	SIG. LEFT	X^2 (df = 3)
LOA/LOT	17	15	3	4	16.28 ***
ROA/ROT	3	14	11	7	7.86 *
OVERALL CHI SQUARE					14.95 **

* $p < .05$

** $p < .01$

*** $p < .001$

TABLE 3

RELATION OF NEONATAL HEAD POSITION PREFERENCE TO HAND PREFERENCE AT 19 WEEKS

	INFANT HANDEDNESS				
HEAD POSITION PREFERENCE	SIG. RIGHT	RIGHT BIAS	LEFT BIAS	SIG. LEFT	X^2 (df=3)
SIGNIFICANTLY RIGHT	11	16	3	3	16.72 ***
RIGHT BIAS	1	8	4	3	
LEFT BIAS	6	2	4	2	2.01 NS
SIGNIFICANTLY LEFT	1	1	3	3	
OVERALL CHI SQUARE			df = 9		17.1 *

* $p < .05$

*** $p < .001$ (N = 71)

TABLE 4

RELATION OF ASYMMETRY OF NEONATAL HEAD POSITION PREFERENCE AND 19 - WEEK HAND PREFERENCE TO BIRTH POSITION

	DIRECTION OF LATERAL PREFERENCE OF HEAD & HAND			
	BOTH RIGHT	BOTH LEFT	ONE RIGHT/ONE LEFT	
BIRTH POSITION				
LOA/LOT	22	2	12	
ROA/ROT	14	10	11	
TOTAL	36	12	23	N = 71